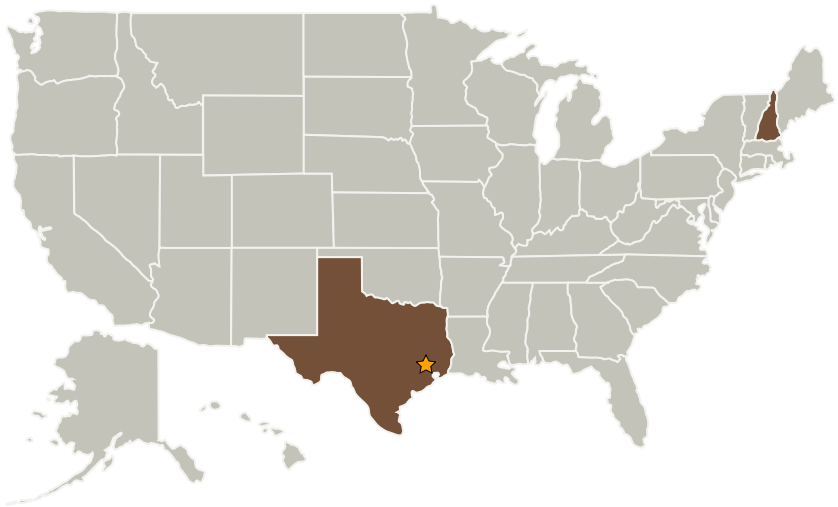
Thermal Management of Superconducting Electromagnets in VASIMR Thrusters, Phase I

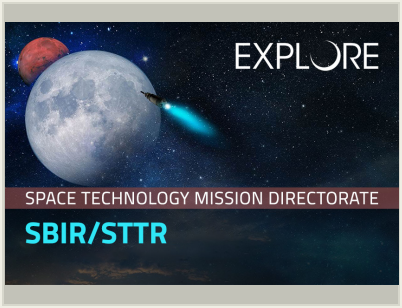
Completed Technology Project (2004 - 2004)

Project Introduction

Future manned space exploration missions will require high power electric propulsion. VASIMR thrusters are the most attractive option because they offer short transit times and low propellant usage. A key component in VASIMR thrusters is the cryogenic electromagnets. Cooling systems for the magnets do not currently exist. The innovation of the proposed project is a high-capacity turbo-Brayton cryocooler for thermal management of VASIMR electromagnets. The cryocooler has heritage in the space-qualified unit that was developed by Creare for the Hubble Space Telescope. Turbo-Brayton cryocoolers are ideal for space applications because they are lightweight, compact, efficient, highly reliable and have long maintenance-free lifetimes (>10 years). Furthermore, the technology scales well to high cooling capacities and is inherently simple to integrate with multiple cooling objects; attributes that are particularly beneficial for VASIMR systems. In Phase I we will design thermal management systems for VASIMR thrusters at power levels consistent with near-term flight experiments and future manned space exploration missions. During Phase II, we will demonstrate a prototype thermal management system. In Phase III we will develop the complete thermal management system, integrate the system with a VASIMR thruster, and demonstrate the system through tests in a thermal vacuum chamber.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Creare LLC	Supporting Organization	Industry	Hanover, New Hampshire

Primary U.S. Work Locations	
New Hampshire	Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Mark Zagarola

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors